

Acid Rain in the Adirondacks:

A Time of Change!

BY KAREN ROY, WALTER KRETZER, HOWARD SIMONIN AND EDWARD BENNETT

Significant progress has been and continues to be made in the reduction of acid rain emissions. Some have viewed this environmental issue as resolved by Congress with the mandated controls under the Clean Air Act Amendments of 1990 (CAAA). But in places like the Adirondacks, acidification of lakes and watersheds continues, seemingly unabated. What can we look forward to? What must happen? This article discusses recent scientific findings, control efforts, New York initiatives, and proposed further Congressional action. In this time of change, the critical needs to document the effectiveness of controls through the monitoring and analysis of atmospheric deposition, lake chemistry and forest indicators are discussed. Finally, the need for further Federal controls, in light of New York's initiatives are highlighted and the opportunities for you, the public, to remain informed on our progress to preserve and protect our environmental heritage for future generations are offered.

Acid deposition has been identified since the mid-1970s as a serious threat to New York State's waters and forests. Emissions of sulfur dioxide (SO₂) and oxides of nitrogen (NO_x) come primarily from the combustion of fossil fuels and can be

transported many miles before they are deposited. These compounds are either converted to sulfuric and nitric acids in the air, or are deposited directly to the soil and then converted to these acids. In sensitive ecosystems, acid deposition can acidify waters and soils. An ecosystem is considered sensitive to acid deposition if it does not have an adequate buffering capacity in its soils to counter the acids. Areas in New York State identified as containing sensitive ecosystems include the Adirondack Mountains, the Catskill Mountains, the Rensselaer Plateau, and the Hudson Highlands (NYSDEC 1996).

Over the years, New York State has worked hard to reduce air emissions which contribute to acidic deposition, including passage of the first acid deposition control act in the nation in 1984. The New York State Legislature realized then that New York could not solve the acidic deposition problem by itself, due to the significant impact of air emissions originating primarily in midwestern states. The DEC reported in its Final Environmental Impact Statement on the Sulfur Deposition Control Program that 83% of the sulfur deposition which occurred in the southwestern Adirondacks originated outside of New York State. The acid deposition control program also sought to establish an Environmental Threshold Value at which no significant damaging chemical or biological effect of acid deposition had been reported, and above which there was a high probability that adverse effects would occur. A value of 20 kilograms of sulfate/hectare/year was selected for sensitive receptor areas, the largest being the Adirondack Park.

A few years later, Congress passed the Clean Air Act Amendments of 1990 (CAAA). Title IV set forth EPA's Acid Rain Program and established a national cap on utility emissions expected to result in an estimated SO₂ emissions reduction of 10 million tons (40%) from 1980 levels in two phases. By 2010, NO_x emissions would be reduced by approximately 10 percent (2 million tons) from 1980 levels. A system of marketable allowances was the centerpiece of the Acid Rain Program (Bennett 1998). EPA was mandated by the CAAA to provide Congress with a report on the feasibility and effectiveness of an acid deposition standard to protect sensitive and critically sensitive aquatic and terrestrial resources. As a result, the *Acid Deposition Standard Feasibility Study* was issued in October 1995. In 1994, Canadian federal and provincial energy and environment ministers issued a Statement of Intent to develop a long-term acid rain strategy for Canada for post-2000. Consequently, the report *Towards a National Acid Rain Strategy* was issued in October 1997. Most recently, in 1998, the U.S. National Acid Precipitation Assessment Program (NAPAP) issued its *Biennial Report to Congress: An Integrated Assessment* presenting the first evaluation of the costs, benefits and effectiveness of the Acid Deposition Control Program covering the results of the first year 1995.

These reports (1995-1998) lead to several major conclusions. First, that the pollution allowance trading program has been a success. Sulfur dioxide emissions have been reduced, and sulfate deposition has decreased. The administrative and implementation costs of the program are less than a traditional regulatory "com-

Karen Roy is a Project Analyst at the Adirondack Park Agency.

Walter Kretzer is Program Manager of the Adirondack Lakes Survey Corporation.

Howard Simonin is a Unit Leader at the Department of Environmental Conservation Division of Fish and Marine Wildlife Resources in Rome, New York.

Edward Bennett is with the Division of Air Resources, Department of Environmental Conservation, Albany.

mand and control" approach. The actual cost of the program is substantially less than projected at the time of adoption of Title IV. Secondly, despite the successes of the innovative regulatory scheme, the reports conclude that the overall cap in emissions is too high to accomplish the primary goal, which was to protect sensitive resource areas from the harmful effects of acid rain. The national cap on emissions of sulfur dioxide from power plants must be further reduced. The reports also agree that nitrogen oxide emissions are also a significant contributor and must also be addressed.

The good news is that emissions of sulfur dioxide have been reduced, and as a result acidic deposition of sulfate has decreased approximately 25 percent. This has led to lower levels of sulfate in Adirondack lakes and streams, approximately 15-20% in monitored waters. The bad news is that we have not observed the large scale improvements in the acidity of Adirondack waters that we had anticipated. Part of the reason is that in addition to decreases in sulfate in rainwater, there have also been decreases in calcium, magnesium and other basic compounds in rainwater which help to neutralize the sulfate. These decreases occurred because we have greatly reduced the particulate or soot portion of air pollution, and in the process we have reduced certain compounds which previously helped to neutralize the acidity of our rain and snow (Simonin 1998). When examining regional trends in surface water recovery from acidification in North America and Europe, Stoddard et al. (1999) found lack of recovery in three regions of North America (midwestern North America, south/central Ontario and the Adirondack/Catskill mountains). The trend patterns in these regions are similar to those observed in the Nordic countries of Europe in the 1980s, where recovery is now occurring. They suggest that larger decreases in sulfur deposition and/or a longer response time (lag) may be needed before similar recovery occurs in these regions of North America.

Status of Adirondack Lakes and Streams

Paleoecological studies involving analysis of Adirondack lake sediment cores collected during the 1980s showed that many of the study lakes became acidic only in the previous 10-50 years, during the time when air pollution and acidic deposition levels were highest due to rapid industrialization. Other studies have similarly documented that fish population declines and losses of entire populations occurred in many lakes within the same time period. Acidification affects more than small, high-elevation lakes. Big Moose Lake in the southwestern Adirondacks is an example of an important lake which has been impacted in recent decades by acidic deposition and has lost important fish populations. Historical records from this 1,286-acre water body document healthy fish in the lake and in nearby streams during the 1930s. Surveys conducted in the 1980s in the North Branch Moose River Watershed (which includes Big Moose Lake), however, showed a serious loss of many fish populations (Schofield and Driscoll 1987).

Acid-sensitive species occur in all major groups of aquatic organisms (Figure 1). Amphibians, aquatic insects, zooplankton, and algae are negatively affected by the increased acidity which is seriously compromising aquatic biodiversity resulting in effects on the food web. For example, loons, eagles, otters and mink, all of which prey on fish, are impacted by the loss of fish populations. Lakes that once were destinations for brook trout fishermen, like Brooktrout Lake, T Lake, Deep Lake, and Lake Colden, among others, are today too acidic to support sport fish populations.

Between 1984 and 1987, the Adirondack Lakes Survey Corporation (ALSC), a joint partnership of the NYS Department of Environmental Conservation (NYSDEC) and the Empire State Electric Energy Research Corporation (ESEERCO), embarked on an intensive survey effort to better characterize the biological and chemical status of Adirondack Lakes.

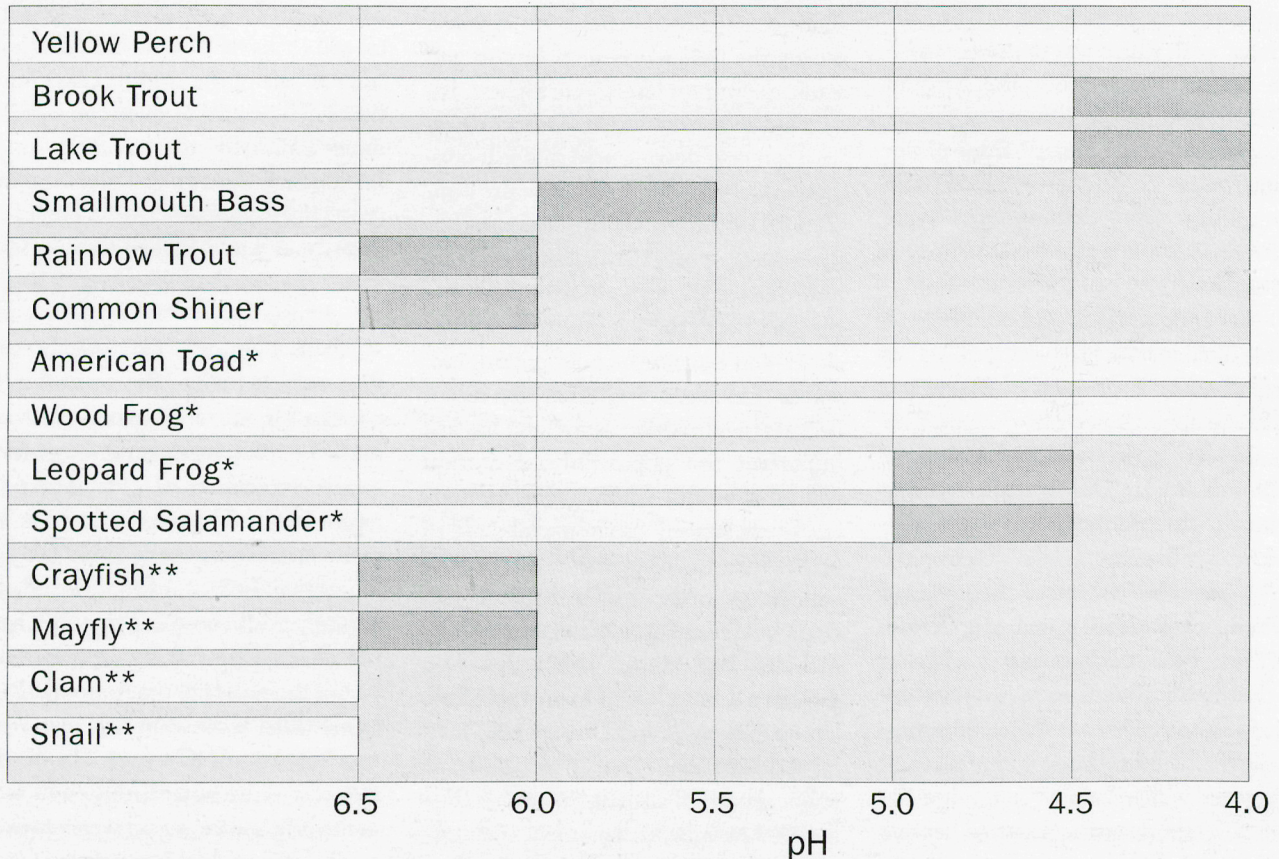
The result of this unique cooperative effort was the acquisition of an unparalleled, extensive chemical, biological and physical data base of 1469 (52%) of the ponded waters in the region. In 1984, the USEPA National Acid Precipitation Assessment Program also collected physical and chemical data on 155 Adirondack lakes as part of the Eastern Lakes Survey (ELS). The results of these two investigations indicated that acidification of Adirondack waters was indeed a serious problem. Approximately 24% of the ALSC waters and 12% of the ELS survey waters (greater than 4 ha in size) had pH values ≤ 5.0 .

In its Report to Congress in 1995, EPA reported that 19% of their target population of Adirondack lakes were acidic in 1984, based on their surveys of waters larger than 10 acres. The ALSC report included lakes less than 10 acres in their extensive survey of 1,469 lakes and found that 24% of Adirondack lakes are seriously acidic, meaning that they have a pH of less than 5.0 and approximately half of the waters in the Adirondacks can be classified as sensitive to acidic deposition based on ANC values. The distribution of sensitive waters ($\text{ANC} \leq 40 \mu\text{eq/L}$) in the Adirondack region is shown in Figure 2. ANC or Acid Neutralizing Capacity is a combined chemical measure of how well a lake can neutralize acid inputs. An ANC of ≤ 40 indicates a water that is vulnerable to episodic acidification. This is significant because it demonstrates that a high percentage (48%) of water bodies in the Adirondacks are unable to absorb current levels of acid rain without becoming critically acidic, thereby jeopardizing aquatic life.

In 1998 the National Acid Precipitation Assessment Program's report to Congress confirmed that Adirondack lakes had not "turned the corner" on recovering chemistry. While the report found that over the last 15 years, lakes and streams throughout many areas of the United States had experienced decreases in sulfate concentrations in response to decreased emissions and deposition of

Figure 1. Critical pH for selected taxa in lakes and streams.

White bars show favorable pH ranges for each type of organism; shaded bars show less favorable ranges; no bar indicates ranges which do not support populations of the organism.



From National Acid Precipitation Assessment Program, 1991. *1990 Integrated Assessment Report*. NAPAP Office of the Director, Washington, D.C.

*Embryonic life states. **Selected Species

sulfur, in contrast, the majority of Adirondack lakes had remained fairly constant while sensitive Adirondack lakes have continued to acidify (NAPAP 1998).

In addition to sensitive lakes, the Adirondack region includes thousands of miles of streams and rivers which are also sensitive to acidic deposition. Over half of these Adirondack streams and rivers may be toxic during spring snowmelt, due to high aluminum concentrations and the acidic water conditions created during episodes. Aquatic life is adversely impacted. Watersheds which experience episodic acidification are very common in the

Adirondack region, and the Report to Congress estimates that 70% of the target population lakes are at risk of episodic acidification at least once during the year. Nitrogen is more of a factor than sulfur in episodic acidification.

Mercury toxicity is another important related issue for aquatic ecosystems of the Adirondacks. Acidification has made mercury and other metals more mobile, and mercury, in particular, has bioaccumulated in fish from acidic waters. Emissions of air toxics, such as mercury, are also being reduced as a result of the Clean Air Act Amendments of 1990. The hope is that

these reductions will lead to lower concentrations of toxic chemicals in Adirondack biota (Simonin and Meyer 1998).

Status of Adirondack Forests

Many factors affect forest health in harsh mountain environments like the Adirondacks. It is, however, becoming increasingly evident that acidic deposition is a critical factor, not only here but in other parts of the country. The 1998 NAPAP Report concluded that both sulfur and nitrogen have caused adverse impacts on certain highly sensitive forest ecosystems in the United States, particu-

larly high-elevation spruce-fir forests. Recent reports from the U.S. Geological Survey found that soil-calcium depletion was linked to acid rain and reduced forest growth in the eastern United States (Lawrence and Huntington 1999). In Canada, areas with the slowest tree growth were found to be the areas where the total acidic deposition exceeded the critical load for that area. Critical load is defined as the amount of acid deposition that a watershed is able to tolerate while allowing 95% of the lakes to maintain a pH of 6.0 or higher (The Acidifying Emissions Task Group 1997). EPA's latest publication on acid rain (EPA 1999) states :

"Acid deposition, combined with other pollutant and natural stress factors, can damage forest ecosystems. Damage could include increased death and decline of Northeastern red spruce at high elevations and decreased growth of red spruce in the southern Appalachians. In some cases, acid deposition is implicated in impairing a tree's winter hardening process, making it susceptible to winter injury. In other cases, acid deposition seems to impair tree health beginning with the roots. As acid rain moves through soils, it also can strip nutrients from the soil and increase the presence of aluminum ions, which are toxic to plants.

Long-term changes in the chemistry of some sensitive soils may have already occurred. In some regions, nitrogen deposition in forests can lead to nitrogen saturation, which occurs when the forest soil has taken up as much nitrogen as possible. Saturated, the soil can no longer retain nutrients and they are leached away. Nitrogen saturation has been observed in a number of regions including Northeastern forests, the Colorado Front Range and the mountain ranges near Los Angeles, California. Effects also have been seen in Canada and Europe. This phenomenon can create nutrient imbalances in the soils and roots of trees, leaving them more vulnerable to the effects of air pollutants such as ozone, climatic extremes such

as drought and cold weather, or pest invasion."

These findings are supported by the forest monitoring data collected over the last 14 years on Whiteface Mountain. Forest ecologists Drs. Eric Miller and Andrew Friedland of Dartmouth College, New Hampshire, collaborate with researchers from other universities focused on high elevation (>600m) forests and their sensitivity to acidic deposition and acidic cloud water. Their studies demonstrate red spruce decline and significant changes in the soil cycling of nitrate.

Further Emissions Reduction Needed

EPA has predicted that based on their best available computer model projections, and assuming full (Phase I and II) implementation of the Clean Air Act Amendments reductions in sulfur emissions, the number of acidic waters in the Adirondacks is expected to increase rather than decrease. In other words, even with full Phase II implementation sulfate decreases scheduled to start this year (2000), EPA projects that the problem of acidic deposition in the Adirondacks will continue to get worse.

Significant additional reductions in both nitrate and sulfate deposition are needed to simply stabilize, much less reverse, the acidic deposition problem in the Adirondacks. In its 1995 Report to Congress, EPA projects that an additional 40-50% reduction over those currently required are needed to simply return the number of acidic Adirondack lakes to 1984 levels. Using the same computer models, EPA predicts that without additional emissions reductions, the number of acidic lakes in the Adirondacks will roughly double by 2040. The 1998 NAPAP report reiterated these findings.

Canada's *National Acid Rain Strategy* found that even with full implementation of the Canadian and U.S. programs in 2010, almost 800,000 km² in southeastern Canada — an area the size of France and the United Kingdom combined — will receive harmful levels of acid rain;

that is, levels above critical load limits for aquatic systems. As a result, 95,000 lakes in southeastern Canada will remain damaged by acid rain.

Since the issuing of these scientific reports, there have been a number of proposed legislative responses, beginning with Senator Moynihan's Acid Rain Control Bill (S.1097), introduced to the 105th Congress in 1997. The Adirondack Park Agency provided testimony in support of this bill praising key components: additional reductions for sulfur dioxide; limits on nitrogen oxide emissions; a report on environmental indications for the Adirondack Park; and the necessary tracking network (APA 1998). This bill was re-introduced in 1999 by Senators Moynihan and Schumer (S.172) with a companion bill in the House by Congressmen Boehlert and Sweeney (H.R. 25). It is supported by the entire NYS Congressional delegation.

In October 1999, Governor Pataki directed DEC Commissioner Cahill to require New York's electric generators to further reduce acid rain causing emissions to protect sensitive areas like the Adirondacks. This directive requires that electric generators in the state reduce SO₂ emissions to 50% beyond the Phase II levels of the Federal Clean Air Act. By agreement with the Ozone Transport Commission, New York also is committed to requiring an additional 40% reduction in summertime NO_x emissions by 2003 to help fight smog. Under Governor Pataki's new directive, New York would require these emissions reductions year-round, rather than just in summer (New York State Executive Chamber 1999). This will help reduce the severity of the acid pulse during spring snowmelt.

Tracking Ecosystem Change is Critical

There are three major areas to track: atmospheric deposition; surface water; and forest indicators. For each area, the responsibility of monitoring is shared among many and in all cases the funding is not adequate to secure long-term tracking. These data collecting programs are vital to determining trends in the data (are

ANC Distribution in ALSC

N = 1469

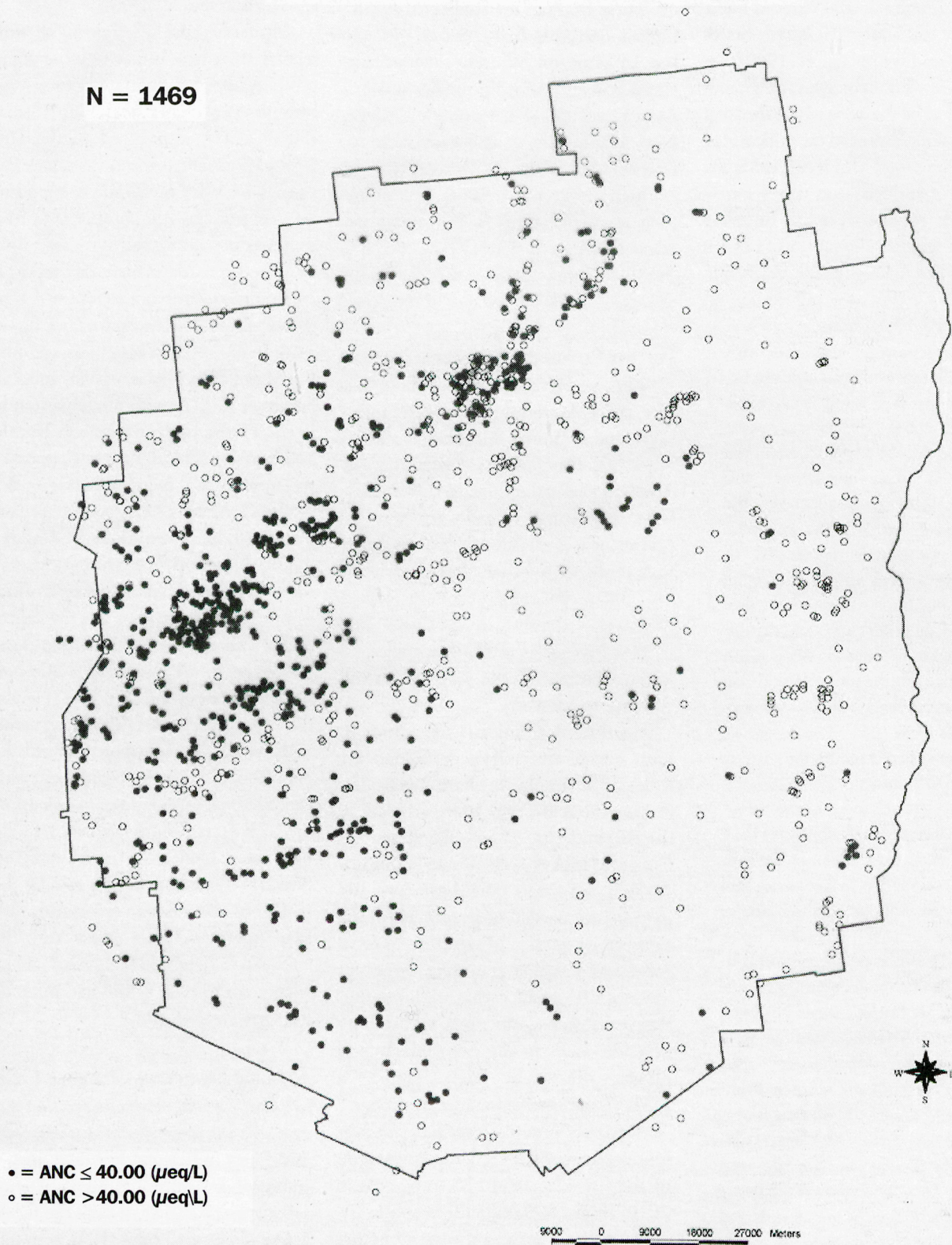


Figure 2, ALSC 1999

indicators going up, down or staying the same?). For all three areas, it is necessary to have an adequate number of monitoring stations and to develop an uninterrupted long-term record in order to detect trends. Methods and data need to be coordinated and shared (NEG/ECP 1998). Lastly, more secure funding for these programs needs to be somehow assured.

Tracking atmospheric deposition

In a recent presentation on the critical value of high-quality long-term monitoring, Dr. Kathleen Weathers cited work from the Hubbard Brook Experimental Forest. Trends in the pH of rainfall there have been tracked since the 1960s. It took over 15 years before a statistically significant trend line could be drawn through the data, which showed it to be rising or improving. During that time, however, there were periods where precipitation pH appeared to be dropping sharply and other times showing no change. The lesson was that shorter time periods were different from each other as well as different from the actual long-term trend (Weathers 1999).

It is critically important, therefore, to continue to monitor acid deposition in New York State and establish whether actual reductions in acid deposition occur as a result of the emission reductions that have been projected over the next decade. Even though large changes in deposition are expected, only one of the five national acid deposition networks that existed in the 1980s remains. This is the National Acid Deposition Program (NADP), and sampling at some stations in this network has already been discontinued. The New York Acid Deposition Monitoring Network is therefore increasingly important, both because it covers important areas of the state such as the western Adirondacks not addressed by the national networks, and also because it may eventually be the only network operating in the state (NYSDEC 1996).

Dry deposition and cloudwater deposition are also very important parts of total

deposition to measure. For example, at Huntington Forest, dry deposition was found to be 55% of total nitrate deposition during the Integrated Forest Study. At Whiteface Mountain, where cloud deposition is common, rainwater accounted for 38%, dry deposition 25%, and cloudwater 37% of total nitrate deposition. Dry deposition monitoring exists in New York, but different techniques are used among collection stations and the monitoring programs are threatened by lack of funds. It took a public relations appeal to prevent the closing of the longest-record dry deposition monitoring station in New York State (APA 1996). Further, there has been only one long-term monitoring site (Whiteface Mountain) for cloudwater deposition, and funding for this program is on the decline.

Tracking lake chemistry

The extensive data collected by the Adirondack Lakes Survey and the EPA Eastern Lakes Survey in the mid-80s and the implementation of the Clean Air Act Amendments of 1990 clearly indicated that there was a need for a more intensive effort to monitor chemical trends and changes in a representative sub-sample of Adirondack waters. A sub-set of 52 lakes representing five of the six major Adirondack lake hydrologic classes were selected in 1992 as long-term monitoring sites and are sampled monthly. Sixteen of the 52 lakes were part of a previous program initiated in 1982.

The Adirondack Long-Term Monitoring Program continues today as a joint venture of the ALSC in cooperation with Syracuse University with support from the NYSDEC, New York State Energy Research and Development Authority and the USEPA Office of Research and Development. Reduced budgets over the last several years, however, have limited valuable interpretive efforts and not allowed for adequate distribution of data to the general public, the environmental community, and legislative staffs in New York and Washington as well as neighboring states and provinces. The original

ALSC survey data are now 13-16 years old with no funding in place to re-visit these waters.

Tracking forest ecosystems

The Whiteface site is the longest-recorded forest ecosystem study in the northeastern US with the most significant historical impact of sulfur pollution. Yet recent funding reductions have caused a shut-down of monitoring plots. The nearest remaining long-term forest monitoring site is at Hubbard Brook, New Hampshire. Due, in part, to the high rates of air pollution loading experienced by high elevation forests of the Adirondacks, these ecosystems have accumulated 80% more sulfur than the low-elevation forest at Hubbard Brook. Therefore, studying Hubbard Brook alone as the single long-term forest ecosystem study representing the northeastern forests will not be adequate to explain or predict what is occurring in Adirondack forests. As previous research has clearly demonstrated, Adirondack high-elevation ecosystems play an important "early warning" role for the entire Northern Forest Region, due to their demonstrated sensitivity to changes in both chemical and physical climates. To adequately assess the effectiveness of the Clean Air Act Amendments on forest health in the northeast (especially high-elevation forests like the Adirondacks) long-term observations of forest element cycling response to reduced atmospheric sulfur loading must be continued. High-elevation mountain forests are one of the signature ecosystems of the Adirondack Park comprising 22% of the Adirondack Park, thus representing a sizable resource. Reduced tree growth and forest ecosystem health are critical considerations on both state and private lands in the Adirondack Park.

In summary, accurate measurements of deposition and ecosystem responses are essential to evaluate policy changes or changes in energy use (i.e., the effect of decreasing or increasing emissions should be reflected in what is delivered to the surface of the earth). This information is

equally important for ecosystem science, where quantifying inputs is critical to interpreting effects and predicting future outcomes. On a more global scale, in light of lagged recovery and the complicating factors of climate variability, Stoddard and others (1999) highlight "the importance of continued coordinated international monitoring to assess the success of acidic deposition control measures".

Conclusion

Full implementation of the 1990 Clean Air Act Amendments will not occur until 2010. Significant additional reductions in both nitrate and sulfate deposition are needed to simply stabilize the acidic deposition problem in the Adirondacks. In order to simply return the quality of water in the Adirondack's water bodies to 1984 levels, a level at which approximately 19% were already acidic, reductions of nitrogen oxides and sulfur dioxide must be reduced by an additional 40-50% over those levels already required at full implementation. Full implementation will not occur until 2010. Since EPA predicts that without such additional emissions reductions the percentage of acidic Adirondack lake will roughly double by 2040, this means that aggressive action is called for now. A number of conservation and landowner groups have established positions to further reduce acid rain. Many people ask what they can do as individuals. We suggest that besides conserving energy in your home, office and automobiles and purchasing clean electric power, you can let your representatives in Washington know your deep concern about the acid precipitation problem in the Adirondacks and elsewhere. Encourage these lawmakers to support legislation limiting sulfur dioxide and nitrogen emissions. The environmental, visibility and human health benefits of further emissions reductions go beyond the Adirondack Park.

For more information, feel free to contact us. We suggest the World Wide Web references provided.

References

- Adirondack Park Agency 1998. Testimony of Richard H. Lefebvre, Chairman, NYS Adirondack Park Agency before the Subcommittee for Clean Air, Wetlands, Private Property and Nuclear Safety of the Senate Environment and Public Works Committee, October 6, 1998, regarding the Acid Deposition Control Act (S.1097) sponsored by New York Senators Alfonse D'Amato and Daniel Patrick Moynihan. [Online] Available: <http://www.northnet.org/-adirondackparkagency/>
- Adirondack Park Agency 1996. Resolution Adopted by the Adirondack Park Agency Concerning EPA's Closing of a Key Acid Deposition Monitoring Station at Endfield, New York. April 16, 1996, Ray Brook, NY. [Online] Available: <http://www.northnet.org/adirondackparkagency/>
- Bennett, E.P. 1998. Acidic deposition — the interplay of regulatory control programs. *Environmental Science & Policy* 1:239-247.
- Lawrence, G. and T.G. Huntington 1999. Soil-Calcium Depletion Linked to Acid Rain and Forest Growth in the Eastern United States. U.S. Geological Survey WRIR 98-4267, 12 pp. [Online] Available: <http://bqs.usgs.gov/acidrain>
- National Acid Precipitation Assessment Program 1998. *Biennial Report to Congress: An Integrated Assessment*. [Online] Available: http://www.nnica.noaa.gov/CENR/NAPAP/NAPAP_96.htm
- New England Governors/Eastern Canadian Premiers, 1998. Acid Rain Action Plan. [Online] Available: <http://www.tiac.net/users/negc>
- New York State Department of Environmental Conservation 1999. *New York State Atmospheric Deposition Monitoring Network. Wet Deposition 1987-1995 Report*. Albany, NY.
- New York State Executive Chamber, October 14, 1999. Press release: Governor Takes Action to Protect New York from Acid Rain: Requires Further Reductions in Acid Rain-Causing Pollution. [Online] Available: http://www.state.ny.us/governor/press/year99/oct14_1_99.htm
- Schofield, C.L. and C.T. Driscoll 1987. Fish species distribution in relation to water quality gradients in the North Branch of the Moose River Basin. *Biogeochemistry* 3:63-85.
- Simonin, H. 1998. The Continuing Saga of Acid Rain. Wild in New York, Spring. *New York State Conservationist*. Albany NY pp 4-5.
- Simonin, H.A. and M.W. Meyer 1998. Mercury and other air toxics in the Adirondack region of New York. *Environmental Science & Policy* 1:199-209.
- Stoddard, J.L., Jefferies, D.S., Lukewille, A., Clair, T.S., Dillon, P.J., Driscoll, C.T., Forsulus, M., Johannessen, M., Kahl, J.S., Kellogg, J.H., Kemp, A., Mannio, J., Montelth, D.T., Murdoch, P.S., Patrick, S., Rebsdorf, A., Skjelkvale, B.L., Stainton, M.P., Traaen, T., van Dam, H., Webster, K.E., Wieting, J., and Wilander, A. 1999. Regional trends in aquatic recovery from acidification in North America and Europe. *Nature* 401(7):575-578.
- The Acidifying Emissions Task Group 1997. *Towards a National Acid Rain Strategy*. Report submitted to the National Air Issues Coordinating Committee, Environment Canada, Ottawa, Ontario, 98 pp.
- U.S. Environmental Protection Agency Acid Rain Division 1995. *Acid Deposition Standard Feasibility Study Report to Congress*. Office of Air and Radiation (6204J), EPA-430-R-95-001a, October 1995.
- U.S. Environmental Protection Agency 1999. *Progress Report on the EPA Acid Rain Program*. U.S. Environmental Protection Agency, Air and Radiation EPA430-R-99-011, November 1999, 21 pp. [Online] Available: <http://www.epa.gov/acidrain/general/acidrainprogress.html>
- Weathers, K. 1999. Conference presentation *Environmental Monitoring, Evaluation and Protection in New York: Linking Science and Policy* Critical Monitoring and Research Needs Panel. New York State Energy Research and Development Authority, December 7-8, 1999, Albany, NY.

Web Site Resources

- EPA's Acid Rain Division (Clean Air Markets Division): www.epa.gov/acidrain
- National Acid Precipitation Assessment Program: www.nnica.noaa.gov/CENR/NAPAP/NAPAP_96.htm
- U.S. Geological Survey: <http://bqs.usgs.gov/acidrain/>
- Clean Air Status and Trends Network: www.epa.gov/acidrain/castnet
- Legislative sites (NYS and US): www.state.ny.us
- New England Governors/Eastern Canadian Premiers: www.tiac.net/users/negc
- New York State Adirondack Park Agency: www.northnet.org/adirondackparkagency
- New York State Department of Environmental Conservation Atmospheric Deposition Monitoring Network: www.dec.state.ny.us/website/dar-baqs/acidrain/index.html
- Adirondack Lakes Survey Corporation: (in progress)